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IMPLICATIONS FOR MODELING CASUALTY SUSTAINMENT DURING PEACEKEEPING OPERATIONS

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SUMMARY

Introduction

Projections of the casualties likely to be incurred during various types of military operations, including peacekeeping operations, are essential for accurate assessments of the health care personnel and medical resources needed to support those operations.

Objective

The objective of the present effort is to examine data detailing the numbers of wounded-in-action (WIA) and killed-in-action (KIA) casualties incurred during previous peacekeeping operations and to assess its potential applicability for providing baseline rates of casualty incidence in a proposed peacekeeping casualty projection model.

Methods

Data detailing fatalities incurred in previous peacekeeping operations and unit strengths of those operations were extracted from several United Nations (UN) electronic sources. From these data, rates of KIA were computed for the deployed forces. National and international news accounts of 188 peacekeeping incidents in which casualties were sustained were then extracted using the WestNews© service. The ratios of WIA to KIA were computed, and wounded-in-action casualty rates were then derived. Casualty data were further analyzed by geographical theater, weapon of attack, severity of wounds, and temporal lag between casualty incidents.

Results

The mean KIA rate across UN operations in regions of potential US involvement was 0.709 per 1,000 strength per year. The estimated mean WIA rate for these operations was 3.16 per 1,000 strength per year; the estimated WIA rate for individual operations ranged from 0.49 to 12.50. There were an average of 3.8 wounded and 0.86 killed in the 188 casualty incidents examined. Thirty-eight percent of the wounds were described as serious.

Conclusions

By utilizing (1) rates of WIA and KIA occurrences observed during past operations, (2) the temporal dispersions of such incidents, and (3) the casualties sustained relative to various weapons possessed by the belligerents, a model can be developed to provide medical planners with baseline rates of casualties that may be expected during future peacekeeping operations.

IMPLICATIONS FOR MODELING CASUALTY SUSTAINMENT DURING PEACEKEEPING OPERATIONS

Introduction

Estimates of the casualties likely to be incurred during various types of military operations are essential for accurate assessments of the health care personnel and medical resources needed to support those operations. The types of casualties for which medical resource planning is needed include nonbattle injuries, disease occurrences, psychiatric casualties, and wounds sustained as a result of hostilities. The medical admissions within this last category, while not typically as numerous as those within the combined disease/nonbattle injury (DNBI) category,[1,2] are what are traditionally thought of as "combat casualties" and are the most resource intensive in terms of the supplies and personnel required for treatment.

Military medical models are typically developed to allow planners to gauge the resources needed to support combat operations. For instance, the Medical Analysis Tool (MAT) is a joint service tool designed to estimate the beds and supplies needed to medically support a combat engagement,[3] while the Estimating Supplies Program (ESP) is a Navy tool used to project the amount of consumable supply requirements needed to treat a particular patient distribution.[4] Such models, however, are dependent upon accurate projections of the numbers of illnesses and injuries anticipated, from which the needed supplies and equipment can then be gauged. Thus, casualty models such as CASEST[5] and FORECAS[6] have been developed to provide estimates of the likely patient streams during various scenarios.

Existing casualty projection models have generally focused on providing estimates for conventional combat scenarios. However, in the last decade or so, with the end of the Cold War, deployments of forces for peacekeeping reasons have gained particular prominence. The post-Cold War period has been characterized by a multitude of civil wars and other intrastate armed conflicts, which have threatened regional peace and security as strife has spilled across nations' borders. As a consequence, this has meant an increased role for U.S. military forces in trying to contain these conflicts and alleviate human suffering.[7-9]

While the potential types of military missions with U.S. involvement have been expanded in recent years,[10,11] the ability to project the likely medical admissions during these nonconventional operations has largely not yet been incorporated into military models. A main reason this

capability has not yet been integrated into existing medical models is due to the lack of empirical data upon which to base casualty projections. Due to the relative recency of many past nonconventional operations, and because they have typically involved relatively small contingents of U.S. forces, the data needed to derive accurate projections for future operations have not been readily obtainable. Nevertheless, the need for casualty projections for peacekeeping-type operations is not lessened by the relative paucity of data from past operations.

It is not uncommon for troops in peacekeeping operations to incur very low numbers of casualties compared with those of conventional warfare. British troops in Operation Resolute 2 in Bosnia from July to November 1996 suffered no wounded-in-action (WIA) or killed-in-action (KIA) casualties.[12] That same year, British troops in Operation Joint Endeavor in Bosnia-Herzegovina incurred only 7 hospitalized WIA from an average population-at-risk of 7,045 troops, yielding a WIA rate of just under 1.0 per 1,000 troops per year.[13] A Mobile Army Surgical Hospital in Zagreb, Croatia, providing medical care to 25,000 troops from October 1992 to March 1994, treated admissions representing an estimated WIA rate of 2.03 per 1,000 troops per year over that 17-month period.[14]

While the operations cited above all had very low rates of casualties, peacekeeping missions also have the potential to yield much higher levels of casualties. The bombing of the airport barracks in Lebanon in 1983 killed or injured more than 300 U.S. Marines deployed in support of the United Nations Force in Lebanon (UNIFIL).[15] Further, the "Blackhawk Down" incident involving U.S. troops in support of the UN mandate in Somalia yielded 18 U.S. soldiers dead and 75 wounded in one 24-hour period.[16] Moreover, an ambush a few months earlier in Somalia resulted in 24 deaths and 58 wounded among Pakistani troops supporting the UN mission.[17]

The considerable variance in casualty incidence observed during prior peacekeeping operations means that forecasts of the likely casualties in a future deployment may be fraught with mathematical uncertainty. The techniques used to model casualties for conventional operations have involved an examination of the strengths of previously deployed forces, a review of the daily casualties sustained within these populations, an assessment of the statistical distributions underlying casualty incidence, analyses of any serial correlation and cross-correlation among casualty types, and then incorporation of the appropriate mathematical algorithms into a software environment.[6] The goal of the present investigation, thus, is to analyze data that may potentially provide a similar empirical basis for projecting casualties for future peacekeeping operations.

Because most of the data available on peacekeeping operations comes from operations conducted under a UN mandate, the focus of the present investigation is on casualties and casualty trends observed during these types of operations.

UN Operations Analyzed

The UN has maintained records of the fatalities incurred during its peacekeeping deployments over the past 50 years.[18] Through March 2001, a total of 1,681 fatalities have been recorded during the course of almost 70 different peacekeeping missions.[18] Military personnel made up 85.4% of these fatalities, while police and observers accounted for another 6.9%.[19] It is to be noted, however, that hostile actions accounted for only 34.4% of the overall fatalities, with accidents, illnesses, and "other" causes responsible for the remainder of the deaths occurring during the UN missions.[20]

The number of hostile deaths incurred during UN operations has varied greatly among the individual deployments. The United Nations Operation in the Congo (ONUC), a 4-year mission in the early 1960s, had the largest number of hostile action fatalities with 135.[20] Another high-casualty mission was the UN Protection Force in the former Yugoslavia (UNPROFOR) with 74 hostile fatalities incurred between 1992 and 1995.[20] Other missions have proved quite benign in terms of the casualties incurred. For example, the United Nations Iran/Iraq Military Observer Group (UNIIMOG), whose mission was to supervise a cease-fire between Iran and Iraq, recorded no hostility-related fatalities over a 30-month period.[20] Further, there have been a number of other smaller UN operations where no fatalities were recorded, and others where the only fatalities came from accidents or illnesses.[20]

Because the current effort seeks to develop a modeling capability that can realistically simulate the expected levels of casualties among U.S. troops participating in peacekeeping operations, the decision was made to use, for baseline purposes, only those prior operations in which U.S. troops were involved or operations in regions in which the United States has in the past had a presence. Ten UN operations, thus, were focused upon to determine the rates of casualties sustained therein. Those operations were: UNPROFOR, UN Preventive Deployment Force in the former Yugoslav Republic of Macedonia (UNPREDEP), UN Confidence Restoration Operation in Croatia (UNCRO), UN Support Mission in Haiti (UNSMIH), UN Operation in Somalia II (UNOSOM II), UN Disengagement Observer Force in the Syrian Golan Heights (UNDOF), UN Iraq-Kuwait

Observer Mission (UNIKOM), UN Interim Force in Lebanon (UNIFIL), and UN Emergency Forces in the Suez Canal sector and in the Sinai Peninsula I and II (UNEF I, UNEF II).

After the operations were identified, the next step was to determine the unit strengths (or populations-at-risk) for these operations. Estimated population-at-risk (PAR) data were obtained for the 10 aforementioned UN operations from documents and Security Council resolutions available on the UN Web site.[21-23] It is noted that the unit strength data for these operations were often culled from several sources that separately reported strengths at various points during the operations; thus, these numbers represent close approximations of the forces involved.

Utilizing the PAR data as the denominators and the UN-reported KIA figures (fatalities caused by hostile actions only) as numerators, KIA rates were computed for the 10 cited operations. Table I indicates the KIA rates per 1000 strength per year for the 10 operations. The mean KIA rate across these operations was 0.709 hostile deaths per 1,000 strength per year. As can be seen, the rates ranged from a low of 0.0 to a high of 2.81. The aggregate rate across these operations was 0.842 per 1,000 strength per year.

Table I. KIA Rates for Selected Peacekeeping operations

UN Operations	KIA Rate*	Avg Force Size
UN Oper. 1	2.81	19,722
UN Oper. 2	0.00	1,300
UN Oper. 3	0.26	1,034
UN Oper. 4	0.11	853
UN Oper. 5	0.73	4,920
UN Oper. 6	0.44	4,650
UN Oper. 7	0.48	4,655
UN Oper. 8	1.57	6,581
UN Oper. 9	0.69	34,731
UN Oper. 10	0.00	978

*Rates are per 1,000 strength per year.

Approximating wounded-in-action rates

While projections of the hostilities-induced fatalities expected during a military operation have utility for manpower planners, medical logisticians need estimates of the anticipated WIA to

reliably assess the medical resources required to support the peacekeeping operation. Though the United Nations maintains data on the fatalities incurred during peacekeeping operations, no such numbers are reported for the nonfatal wounds sustained.

To obtain an estimate of the numbers of nonfatal wounds that might be expected, news accounts concerning peacekeeping incidents where casualties were sustained were examined for the 15-year period between 1986 and 2000. Utilizing the WestNews© service, electronic searches were performed using the key terms "peacekeeping" (and all variations), "casualties," "injuries", "wounded," "deaths", and "killed." From the thousands of hits obtained, 188 separate peacekeeping incidents were identified in the national and international press that represented casualties incurred due to hostile actions during peacekeeping operations. Figure 1 provides a breakdown of the geographical regions of the various incidents. Figure 2 is a display of the various casualty incidents by weapon used in the attack, and Figure 3 graphically depicts the numbers of casualties (wounded and killed combined) sustained in these 188 incidents by the weapon type.

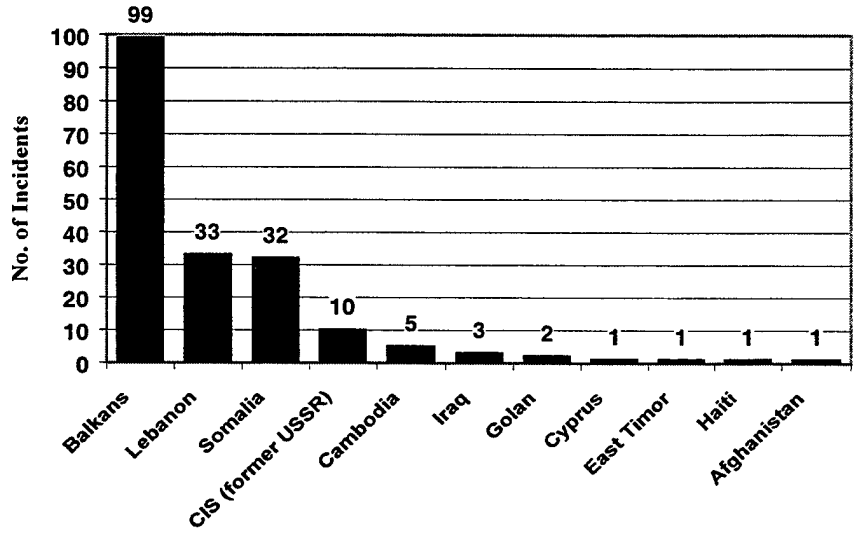

Figure 1. Geographical regions of casualty incidents examined.

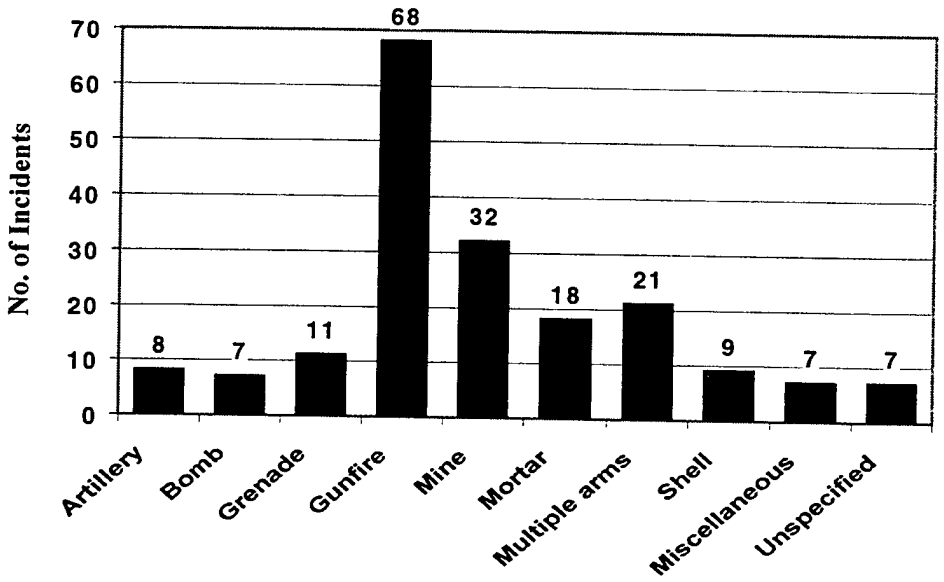

Figure 2. Attacks by weapon type across 188 peacekeeping incidents with casualties.

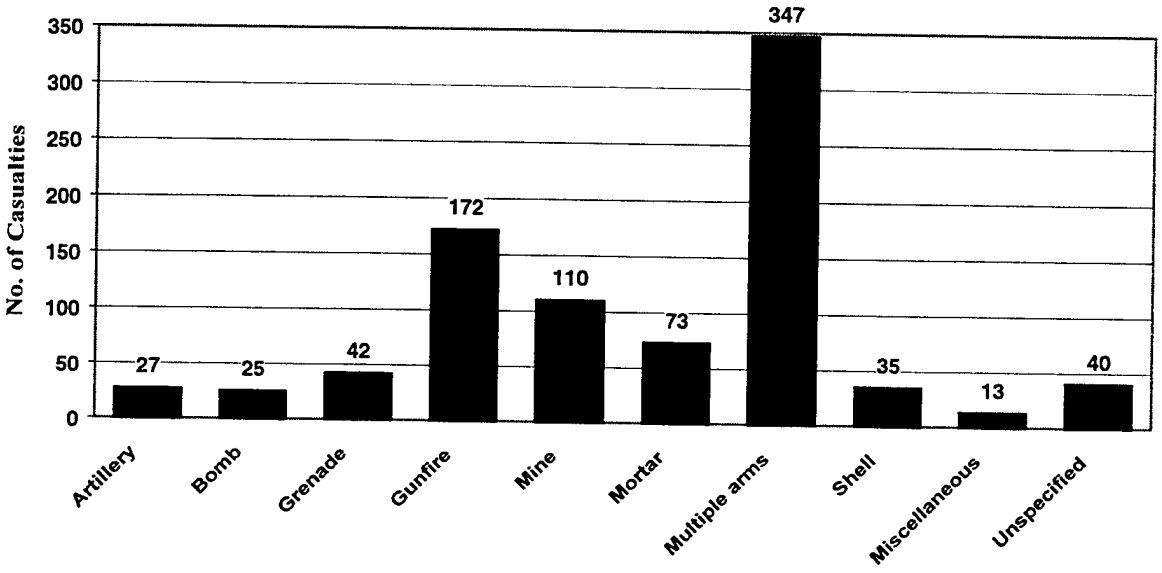

Figure 3. Casualties by weapon type across 188 peacekeeping incidents.

Figure 4 is a presentation of the mean casualties sustained by weapon type across the peacekeeping incidents. Altogether there were 884 casualties in these 188 casualty incidents. Figures 5 and 6 are displays of the percentage distributions of wounded in action (722 total WIA) and killed in action (162 total KIA) by weapon of attack. There were an average of 3.84 wounded and 0.86 killed in the casualty incidents examined.

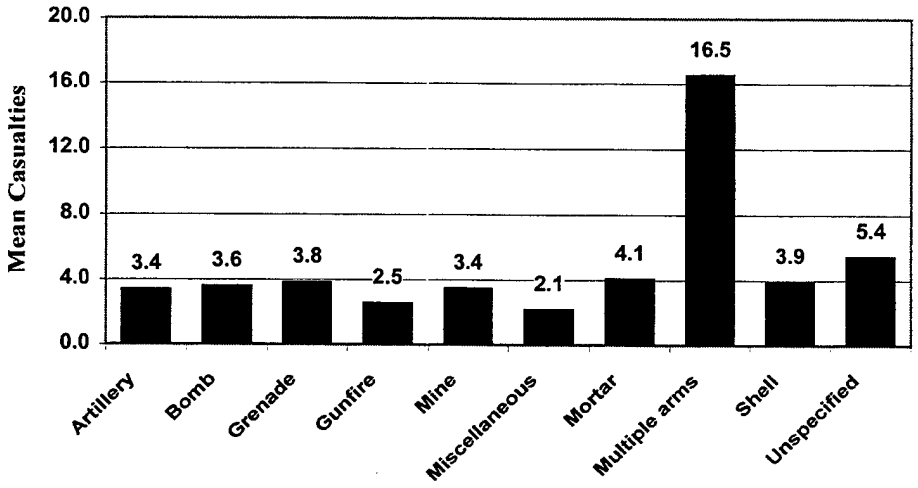

Figure 4. Mean casualties by weapon type in peacekeeping incidents involving casualties.

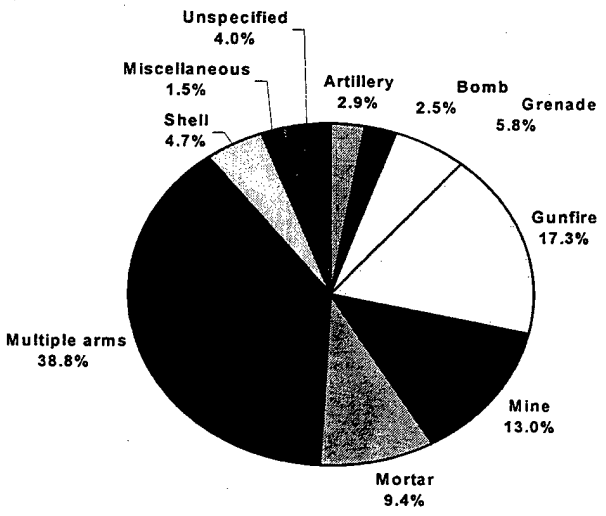

Figure 5. Wounded-in-action casualties by weapon in peacekeeping incidents.

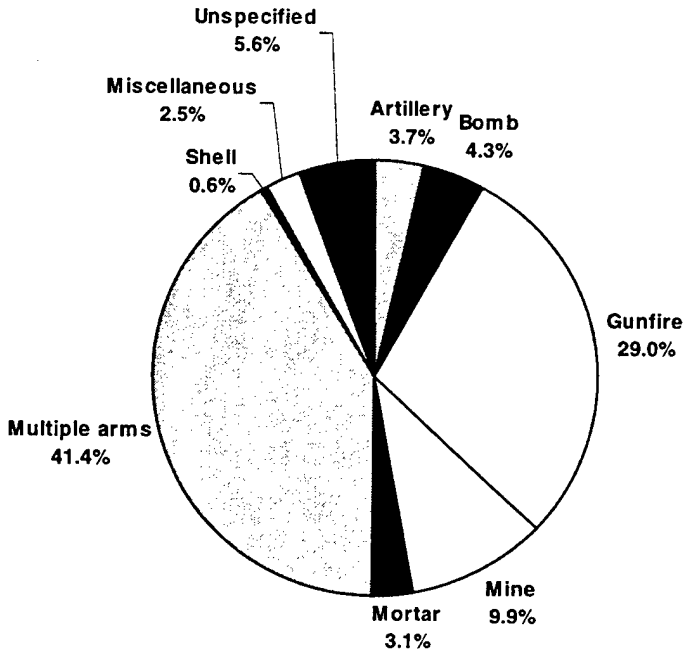

Figure 6. Distribution of killed-in-action casualties by weapon in peacekeeping incidents.

Estimated WIA Rates for Peacekeeping Operations

By examining the ratio of WIA to KIA in the 188 peacekeeping incidents, and by combining this information with the known KIA incidence rates reported earlier in this report, estimates of WIA rates may be calculated for the past peacekeeping operations. Thus, where the ratio of WIA to KIA over the 188 casualty incidents was 4.45:1, and where the mean KIA rate across the 10 aforementioned operations was 0.709 per 1,000 strength per year, then the mean WIA rate can be estimated to be approximately 3.16 per 1,000 strength per year for these operations. However, a simple mean rate across operations does not do justice to the variability in WIA rates that may be observed between differing operations. Table II is a display of the estimated WIA rates for the individual UN operations mentioned previously for which KIA rates were calculated. The estimated WIA rates varied from a low of 0.49 per 1,000 strength annually to a high of 12.50.

Table II. Estimated WIA Rates for Select Peacekeeping Operations

UN Operations	WIA Rate*	Avg Force size
UN Oper. 1	12.50	19,722
UN Oper. 2	**	1,300
UN Oper. 3	1.16	1,034
UN Oper. 4	0.49	853
UN Oper. 5	3.24	4,920
UN Oper. 6	1.96	4,650
UN Oper. 7	2.14	4,655
UN Oper. 8	6.99	6,581
UN Oper. 9	3.07	34,731
UN Oper. 10	**	978

* Rates are per 1,000 strength per year and derived from operational KIA rates and the WIA:KIA ratio observed in 188 casualty incidents.
** Not estimable from KIA rate.

Severity of Wounds

As previously noted, there were 722 wounded personnel reported for the 188 incidents involving hostilities directed at UN peacekeeping forces. As with conventional military operations, though, there was considerable variability in the severity of the wounds sustained. Not all accounts of the casualty-producing incidents provided information as to the severity of the wounds incurred. However, 208 of the injuries reported were accompanied by descriptions of whether the wounds were slight, critical, severe, or life-threatening. Figure 7 is a chart depicting the percentages of serious versus non-serious wounds sustained in the documented peacekeeping incidents. Table III provides a breakdown of wound severity by wounding agent.

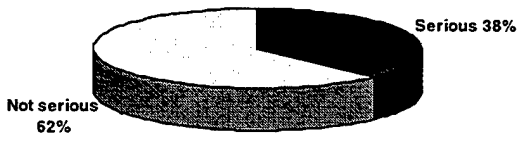

Figure 7. Severity of injuries incurred in peacekeeping operations incidents (n=208).

Table III. Severity of UN Peacekeeper Injuries by Wounding Agent

Cause of Wound	Number of Seriously Injured	Number of Not Seriously Injured
Artillery	5	6
Bomb	3	1
Grenade	3	5
Gunfire	23	23
Mine	17	27
Mortar	9	28
Multiple arms	7	21
Shell	11	16
Other	0	3
Total	78	130

Temporal Distribution of Casualty Incidents

Unlike conventional warfare, which features a daily or near-daily casualty stream, peacekeeping missions and peace enforcement operations have not only lower casualty rates, but also a much lower percentage of days in which casualties are sustained. In peacekeeping operations, sometimes weeks or even months can pass without the occurrence of a casualty incident. Yet there can also be periods of heightened tensions with recurring casualty incidents over brief temporal periods. Figure 8 is a display of the temporal lag between documented casualty-producing incidents during UN operations in the former Republic of Yugoslavia. Data points on the graph represent the number of days between a reported casualty incident and the next such incident. As can be seen, the graph shows a 48-day lag between the first two casualty incidents occurring in the examined time period. The second incident was followed by a zero-day lag (in other words, two separate incidents occurred on the same day) and then by a 14-day lag. Figure 9 presents the temporal lag between reported casualty incidents involving peacekeeping forces in Somalia.

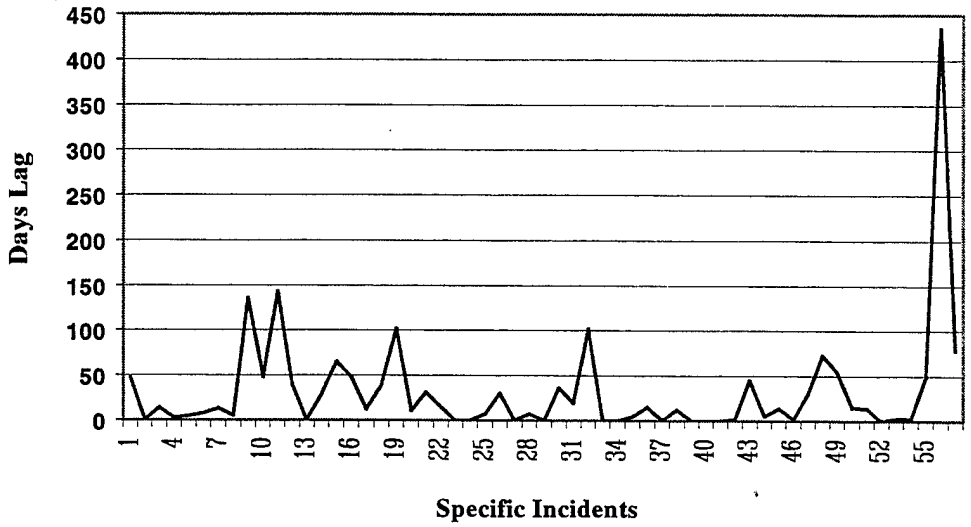

Figure 8. Temporal lag between incidents in which peacekeeping forces incurred casualties in the Former Republic of Yugoslavia.

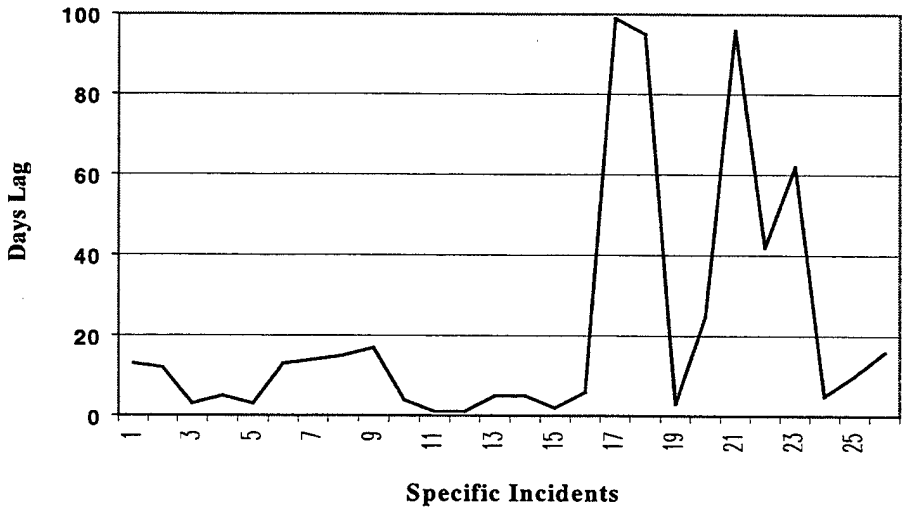

Figure 9. Temporal lag between incidents in which peacekeeping forces incurred casualties in Somalia.

Discussion

The variability in casualty sustainment observed in previous peacekeeping missions makes the development of a rigorous casualty estimation model problematic. Key variables used in forecasting casualties in conventional combat models include battle intensity, force size, force composition (troop type), duration of the operation, and adversary factors, such as weapons parity and unit cohesion, terrain, and climate. Some of these factors may not be as important in peacekeeping operations. First, while conventional warfare models often distinguish between infantry and support troop casualty rates, this distinction may not have the same application in peacekeeping operations since often most troops are generally thought of as in a supporting role, as opposed to a direct combat role. Second, adversary factors may be less crucial since unit-to-unit confrontation is typically not present in these operations. Finally, while climate and terrain may have some impact on casualty rates for peacekeeping operations, the data on these variables simply do not exist in sufficient quantity to allow modeling of these kind of distinctions.

Variables to be considered in any peacekeeping operation model are duration of mission, some measure of animosity toward the deployed force, and force size. In their paper on UN fatalities, Seet and Burnham classified UN operations at levels that roughly correspond to intensity levels: Level 1 missions being those with only unarmed observers or civilian police monitors; Level 2 encompassed missions such as those where UN forces were interposed between belligerent forces to prevent the escalation of hostilities; and Level 3 missions were those with "a mandate authorizing use of all measures necessary, including military force, to maintain or restore international peace and security."[24] The authors of this study found KIA rates to be more than twice as high for Level 3 missions than for Level 1 and Level 2 missions.[24] However, the differences between intensity levels for peacekeeping operations are often not clear, particularly at the outset of a deployment. Some operations, like humanitarian missions, may be fairly benign; other operations, such as the action in Somalia, start off as "peace" missions and end up falling just short of conventional combat. The purpose of a mission can change during the course of the mission, and/or the rules of engagement can be modified. Further, from a casualty standpoint, matters are further complicated by the threat of terrorist acts against barracks and off-duty personnel that can yield mass trauma situations.

Notwithstanding the difficulties in modeling casualties, US forces will undoubtedly be involved in peacekeeping operations in the future. On occasion, the United States may play a major role in

a military engagement that precedes a subsequent peacekeeping operation. At other times, US forces may be a part of a multinational coalition involving the deployment of American combat and/or logistical troops. To assist medical planners in being prepared for the occurrence of the battle wounds that are a regrettable part of most peacekeeping operations, the Naval Health Research Center has begun an effort to model the casualties likely to be sustained in such operations. The analyses in the present report provide a starting point for such a model. By utilizing (1) rates of WIA and KIA occurrences observed during past operations, (2) the temporal dispersions of such incidents, and (3) the casualties sustained relative to various weapons possessed by the belligerents, a model will be developed to provide planners with baseline rates of casualties that may be expected during future peacekeeping operations.

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14. ABSTRACT (maximum 200 words)

Data detailing fatalities incurred in previous peacekeeping operations and unit strengths of those operations were extracted from several United Nations sources. From these data, rates of killed-in-action (KIA) were computed for the deployed forces. National and international news accounts of 188 peacekeeping incidents in which casualties were sustained were then extracted using the WestNews service. The ratios of wounded-in-action (WIA) to KIA were computed, and WIA casualty rates were then derived. Casualty data were further analyzed by geographical theater, weapon of attack, severity of wounds, and temporal lag between casualty incidents. The mean KIA rate across UN operations in regions of potential US involvement was 0.709 per 1,000 strength per year. The estimated mean WIA rate for these operations was 3.16 per 1,000 strength per year; the estimated WIA rate for individual operations ranged from 0.49 to 12.50. There were an average of 3.8 wounded and 0.86 killed in the 188 casualty incidents examined. Thirty-eight percent of the wounds were described as serious. The baseline casualty rates of this investigation can be used to provide a basis for projecting casualties expected in future peacekeeping operations.

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